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# New or Noteworthy Species of *Cardamine* (Brassicaceae) from China

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**ABSTRACT.** *Cardamine changbaiana*, *C. fargesiana*, and *C. lihengiana* are described as new, and their relationships and distinguishing characters are discussed. The new combination *C. purpurascens* is proposed, and a detailed description and specimen citation of this poorly understood species of *Cardamine* are provided.

During revision of the Brassicaceae for the forthcoming volume 8 of the *Flora of China*, it became necessary to provide formal description of the following novelties to make the names available for this volume.

***Cardamine changbaiana*** Al-Shehbaz, sp. nov.

TYPE: China. Jilin: Changbai Shan, Tianchi, rocky slopes, 2600 m, 1 Aug. 1957, *Qian Jiaju* 580 (holotype, PE).

Herba perennis scaposa, glabra, rhizomata, 2–8 cm alta. Folia basalia rosulata, ovata, subcordata, vel oblonga, simplicia vel triloba, 2–10 × 1.5–8 mm; petiolis nonauriculatis, 0.3–3.5 cm longis. Folia caulina nulla vel unum. Pedicelli fructiferi 2–7 mm longi, erecti. Sepala oblonga, 1.3–1.7 × 0.6–0.8 mm. Petala alba, obovata, 3–3.5 × 1.5–1.8 mm. Fructus lineares, 1–2 cm × 1.3–2 mm; stylo 0.5–2 mm longo. Semina oblonga vel oblongo-ovata, 1.2–1.5 × 0.8–1.1 mm.

Perennial herbs 2–8 cm tall, scapose, glabrous throughout. Rhizome slender, 0.4–0.7 mm diam. Stems erect, leafless, or rarely 1-leaved. Basal leaves rosulate, fleshy; petiole 0.3–3.5 cm long; leaf blade simple or rarely 3-lobed, broadly ovate, subcordate, or oblong, 2–10 × 1.5–8 mm, cordate to obtuse, margins entire or repand, apex rounded to obtuse. Cauline leaves absent, rarely 1 and petiolate, similar but narrower than basal leaves, petiole base not auriculate. Racemes terminal, 2- to 5(to 7)-flowered, ebracteate. Fruiting pedicels erect to subscending, 2–7 mm long, straight. Sepals oblong, 1.3–1.7 × 0.6–0.8 mm. Petals white, obovate, 3–3.5 × 1.5–1.8 mm, base tapering into claw 0.4–1 mm long, apex rounded to subemarginate. Filaments 1.4–2 mm long; anthers oblong, 0.6–0.8 mm long. Ovules 8 to 12 per ovary. Fruit linear, 1–2 cm × 1.3–2 mm; gynophore 0.3–1 mm long; valves smooth, glabrous; style 0.5–2 mm long. Seeds

brown, oblong to oblong-ovate, 1.2–1.5 × 0.8–1.1 mm, neither winged nor margined.

*Phenology.* Flowering and fruiting in July and August.

*Habitat.* Rocky slopes on wet soil; elevation 2500–2600 m.

*Distribution.* China (Jilin Province).

On the basis of Nakai's (1914) original description of *Cardamine resedifolia* L. var. *morii* Nakai, it appears that the variety is the same as *C. changbaiana*, sharing similar plant size, fruit length, and long-petiolate leaves. For reasons discussed below, however, I prefer to describe the taxon as a new species instead of proposing a new combination without examining the two syntypes of that variety. Nakai (1914) indicated that the petals of variety *morii* are 5 mm long and the leaves are lyrate, but in the three specimens of *C. changbaiana* available for my study, the petals are 3–3.5 mm long and the leaves are simple.

*Cardamine changbaiana* is clearly very different from the European *C. resedifolia* in a number of features. The former has petals 3–3.5 mm long, wingless seeds, oblong anthers 0.6–0.8 mm long, leafless or 1-leaved stems, nonauriculate petiolar bases, smooth fruit valves, 8 to 12 ovules per ovary, and undivided cauline leaves. By contrast, *C. resedifolia* has petals 5–6 mm long, broadly winged seeds (wing ca. 0.5 mm diam.), ovate anthers 0.2–0.4 mm long, leafy stems, strongly auriculate to amplexicaul petiolar bases, torulose valves, 20 to 30 ovules per ovary, and pinnatisect to deeply ternate cauline leaves (Akeroyd, 1993; Schultze-Motel, 1986). Furthermore, the type locality of *C. changbaiana* is separated by about 10,000 air miles from the nearest site of *C. resedifolia* in Rumania (Jalas & Suominen, 1994), and I prefer not to recognize the two as varieties of a single species. *Cardamine changbaiana* and *C. resedifolia* are well illustrated in Cheo (1987) and Schultze-Motel (1986), respectively.

The nearest relative of *Cardamine changbaiana* is *C. nipponica* Franchet & Savatier (Japan, Taiwan). The former has leafless or rarely 1-leaved stems, simple or rarely 3-lobed basal leaves, nonauriculate petioles, obovate petals 3–3.5 mm, and

marginless seeds. By contrast, *C. nipponica* has 2- or 3-leaved stems, (3)- or 5- or 7-foliolate basal leaves, cauline leaves with auriculate to amplexicaul petiolar bases, spatulate petals 5–6 mm, and apically margined seeds.

*Paratypes.* CHINA. **Jilin:** Antu County, NNE slope of volcano Chang Bai Shan, 2500 m, 23 July 1986, *Hong Deyan, W. H. Sauer, S. Gerbert & Yang Ye 32829* (PE); Chang Bai Shan, between Nidoli and Tianchi, 2500 m, 22 July 1950, *M. Noda 451* (LE).

**Cardamine purpurascens** (O. E. Schulz) Al-Shehbaz, T. Y. Cheo, L. L. Lou & G. Yang, comb. nov. Basionym: *Cardamine microzyga* O. E. Schulz var. *purpurascens* O. E. Schulz, Notizbl. Bot. Gart. Berlin-Dahlem 11: 225. 1931. TYPE: China. SW Sichuan: Kulu mountains, E of Muli Gomba, 4300 m, June 1928, *J. F. Rock 16487* (lectotype, here designated, B; isotypes, E, MO, US).

Perennial herbs (8–)10–25(–30) cm tall, pilose; rhizomes stout, 0.5–1.5 cm long, often with several stolons. Stems erect, simple, pilose. Basal leaves rosulate, 5–10 cm long; petiole 1–3.5 cm long, ciliate; terminal leaflet subreniform to orbicular, 4–8 × 4–10 mm, petiolule 1–3 mm long, base rounded to cordate, margin entire to obscurely and obtusely 3–5-lobed; lateral leaflets 3 to 7 pairs, obovate to suborbicular, symmetric or not, slightly smaller than terminal lobe, entire or obscurely toothed, apex rounded. Cauline leaves 2 to 10, 1–5 cm long; petiole (2–)4–10(–15) mm long, ciliate, not auriculate at base; terminal leaflet linear, oblong, or lanceolate, 3–9 × 0.5–2 mm, sessile or petiolule to 1.5 mm long; lateral leaflets 4 to 7 pairs, narrowly oblong to oblong-ovate, subequaling terminal leaflet, symmetric or not, pilose, base oblique or cuneate, proximal margin entire or 1-toothed, distal margin entire, apex acute. Racemes terminal, many-flowered. Flowering pedicel ascending to divaricate-ascending, 1–3 cm long, slender, pilose, not appressed to rachis. Sepals oblong to ovate, 3–4 × 1.5–2 mm, pilose, margin membranous, base of lateral pair saccate. Petals magenta-red, purple, or lavender, broadly obovate, 7–11 × 3–6 mm, cuneate into clawlike base to 2 mm long, apex rounded. Median filament pairs 4–5 mm long, flattened below anther; lateral pair 2.5–3.5 mm long; anthers narrowly oblong, 0.9–1.2 mm long. Ovules 10 to 14 per locule. Fruit and seeds not seen.

*Phenology.* Flowering May through July.

*Habitat.* River banks, wood margins, marshy places, swampy meadows, *Rhododendron* scrub; elevation 3500–4400 m.

*Distribution.* Endemic to China (SW Sichuan and adjacent Yunnan).

*Specimens examined.* CHINA. **Sichuan:** Litang-Yalung divide, *Kingdon Ward 4377* (E); Muli or Mili Kingdom, *Rock 6462* (GH, P, US, W); mountains between Litang and Yalung rivers, between Muli Gomba and Baurong and Wa-Erh-Dje, *Rock 16655* (F, US, W); between Baurong and Kulu, W of Yalung River, *Rock 17842* (GH, P, US); Muli, Ha-lu, *Yü 6990* (A, PE). **Yunnan:** Zhongdian, road to Haba Shan, 27°44'05"N, 99°58'09"E, *ACE 224* (K).

Although Schulz (1931) cited four syntypes of *Cardamine microzyga* var. *purpurascens*, the taxon was not lectotypified by Lan and Cheo (1981) when it was raised to specific rank under *Loxostemon* J. D. Hooker & Thomson. The flattened median staminal filaments were used by Lan and Cheo as the basis for inclusion of the species in *Loxostemon*, but as indicated by Al-Shehbaz and Yang (1998), this genus is artificially separated from *Cardamine* solely on the basis of that staminal character.

*Cardamine purpurascens* is most closely related to *C. microzyga* from which it is readily distinguished by having much thickened, stoloniferous, short (0.5–1.5 cm) rhizomes, divaricate-ascending to ascending pedicels not appressed to the rachis, and often entire lateral leaflets of upper leaves that are markedly narrower than those of the basal leaves. By contrast, *C. microzyga* has slender, non-stoloniferous, very long (at least 5 cm long) rhizomes, erect fruits and fruiting pedicels appressed to the rachis, and coarsely 1- or 2-toothed lateral leaflets of the cauline leaves that are more or less similar to those of the basal leaves. *Cardamine purpurascens* was reduced by Li et al. (1995) to synonymy of *C. microzyga*, but the two are sufficiently different to be recognized as distinct species. On the other hand, the treatment by Tan et al. (1999) of the two species in different genera (as *Loxostemon purpurascens* and *C. microzyga*) clearly distorts their close relationship.

**Cardamine fargesiana** Al-Shehbaz, sp. nov.

TYPE: China. Sichuan: Tchen-kéou-tin, no specific locality or date given, *R. P. Farges 1341 bis* (holotype, P; isotype, P). Figure 1.

Herba perennis 8–23 cm alta, caulibus rhizomatibus et stolonibus crispo-pilosis, caulibus distalibus glabris. Folia basalia orbiculata, 5–12 mm diam., palmatinervia, abaxialiter glabra, adaxialiter pilosa. Folia caulina pinnatisecta, sessilia, lobis terminalibus obovatis, tridentatis; lobis lateralibus 4–6 jugis, linearibus vel lineari-lanceolatis, integris. Racemi 3–7 flori. Pedicelli floriferi 5–12 mm longi. Sepala ovata, 2.5–3 × 1.2–1.6 mm, glabra, lateralia saccata. Petala alba, obovata, 5–6 × 2.5–3 mm. Filamenta mediana 3–3.5 mm longa, filamenta lateralia 2–2.5 mm

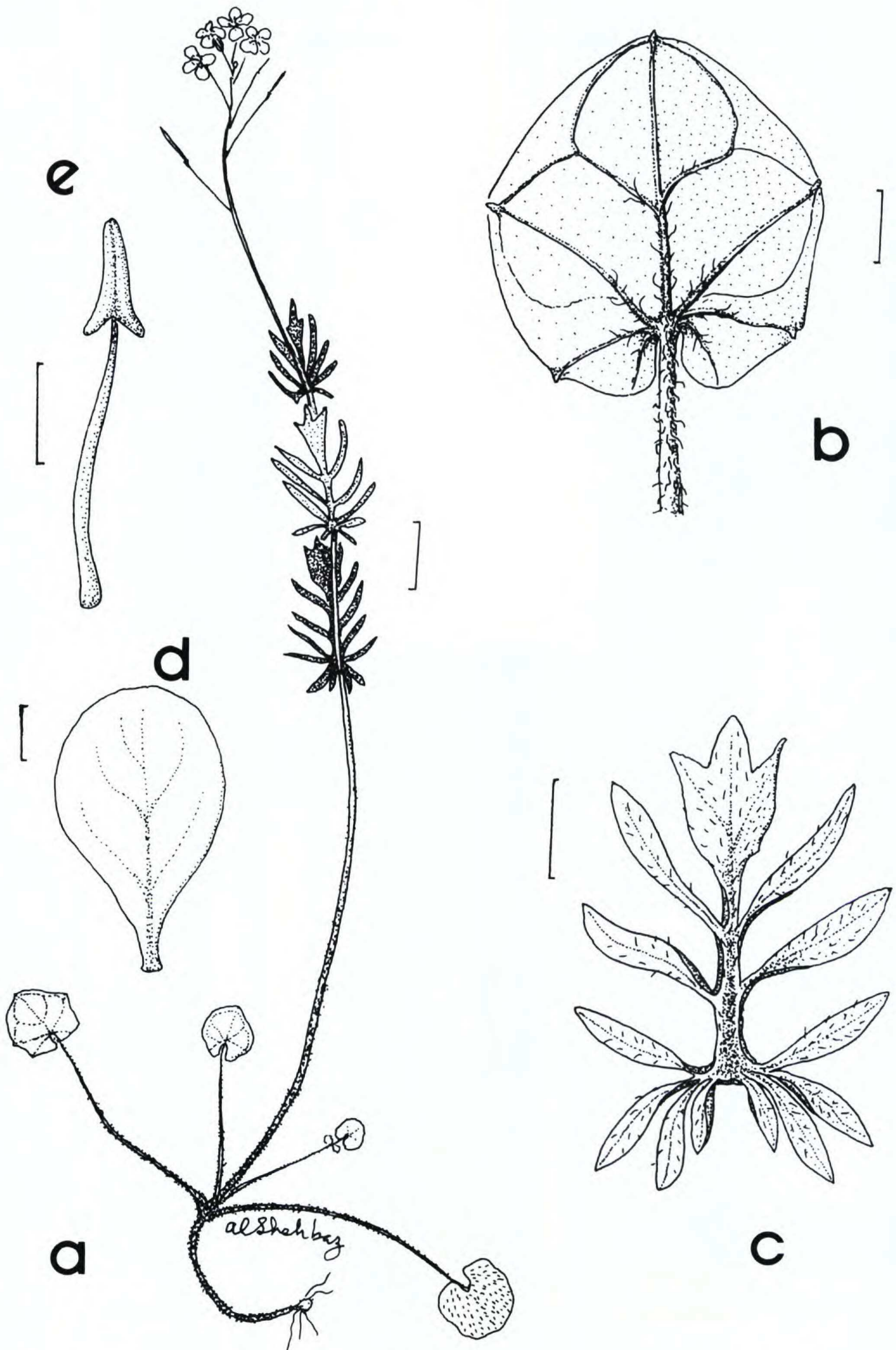


Figure 1. *Cardamine fargesiana* Al-Shehbaz. —A. Plant. —B. Basal leaf abaxial view. —C. Cauline leaf adaxial view. —D. Petal. —E. Median stamen. Scale: A = 1 cm; B = 2 mm; C = 5 mm; D, E = 1 mm. Drawn by Al-Shehbaz from the holotype (*Farges 1341 bis*).

longa; antherae oblongae, 0.8–1.1 mm longae, basi sagittatae. Fructus et semina ignota.

Perennial herbs 8–23 cm tall. Rhizome ovoid to oblong, 2–5 × 1.5–2 mm. Stolons slender, densely pilose with crisped trichomes, thickened at plant base. Stems simple, erect, densely crisped pilose at base, gradually sparser upward, completely glabrous at raceme. Basal leaves 1 to 4 per plant, simple or rarely with a pair of leaflet-like lobes; petiole 0.5–4.5 cm long, densely crisped pilose; leaf blade orbicular, 5–12 mm diam., palmately 5-veined, abaxially glabrous or sparsely pilose along proximal portion of veins, adaxially pilose with simple, straight trichomes to 0.5 mm long, base cordate, margin entire or obscurely 5-angled, mucronate at vein tips; principal veins prominent abaxially, not branched, connected near margin. Cauline leaves 3 to 5, 0.9–2.2 × 0.7–1.5 cm, broadly ovate to oblong in outline, pinnatisect, abaxially glabrous, adaxially pilose; petiole absent and leaf base appearing auriculate; rachis 2–15 mm long; terminal lobe of lowermost leaf obovate, 4–14 × 2–6 mm, apically 3-toothed, sometimes with a minute tooth subbasally on each side, base cuneate into a petiolule to 3 mm long, margin entire, apex mucronate; lateral lobes 4 to 6, linear to lanceolate-linear, margin entire, apex acute, proximal 2 to 4 lobes attached at one point on each side of rachis. Uppermost leaves shorter and with narrower lobes. Racemes 3- to 7-flowered. Flowering pedicels ascending, 5–12 mm long, straight, glabrous. Sepals ovate, 2.5–3 × 1.2–1.6 mm, glabrous, margin and apex membranous, lateral pairs saccate. Petals white, broadly obovate, 5–6 × 2.5–3 mm, apex rounded. Median filament pairs 3–3.5 mm long, slender, lateral pair 2–2.5 mm long; anthers oblong, 0.8–1.1 mm long, base sagittate. Pistil glabrous; style 1–1.5 mm long; stigma entire. Fruits and seeds not seen.

*Cardamine fargesiana* is one of the most distinctive of all Asian species of *Cardamine*. It is readily distinguished by its strongly dimorphic leaves: the basal leaves are simple, orbicular, and palmately veined, whereas the cauline leaves are sessile, pinnatisect, and have a 3-lobed terminal lobe and linear to linear-lanceolate lateral lobes the proximal pair of which is auricle-like (Fig. 1). Although *C. fargesiana* does not appear to be closely related to any other species, it belongs to a group of six species that have sessile cauline leaves with auricle-like proximal leaflets or leaf lobes. This group includes *C. lyrata* Bunge, *C. griffithii* J. D. Hooker & Thomson, *C. hygrophila* T. Y. Cheo & R. C. Fang, *C. engleriana* O. E. Schulz, *C. multijuga*

Franchet, and *C. gracilis* (O. E. Schulz) T. Y. Cheo & R. C. Fang.

*Paratype* (perhaps unnumbered type collection). China. **Sichuan**: Tchen-kéou-tin, no specific locality or date given, *R. P. Farges s.n.* (P).

***Cardamine lihengiana*** Al-Shehbaz, sp. nov.

TYPE: China. Yunnan: Yiliang, Xia Cao Ba, 1900 m, 16 June 1982, *Li Heng, Chen Yü & Yü Hongyuan 1267* (holotype, KUN; isotype, KUN). Figure 2.

Herba perennis rhizomata, 30–50 cm alta, glabra. Rhizofolia et folia caulina inferiora petiolata, reniformia vel suborbiculata, 0.7–2.5 × 1–3 cm, palmatinervia, repandocrenata, 5- vel 7-angulata, petiolis nonauriculatis. Racemi omnino bracteati, laxi. Pedicelli fructiferi 1.5–3 cm longi, recti, ascendentes. Sepala ovata, 1.5–1.8 × 0.9–1 mm, nonsaccata. Petala alba, obovata, 3.5–4.5 × 1.5–2 mm. Fructus lineares, 2–3.6 cm longi, glabri; stylo 1–2 mm longo. Semina oblonga, 1.2–1.4 × 0.7–0.9 mm, nonalata.

Perennial herbs 30–50 cm tall, glabrous throughout. Rhizomes slender, without stolons. Stems erect, angled, with long internodes usually more than 2 cm. Rhizomal and lower cauline leaves simple; petiole 1–4 cm long, not auriculate at base; leaf blade reniform to suborbicular, 0.7–2.5 × 1–3 cm, palmately veined, base cordate, margin repand-crenate, obscurely to distinctly 5- or 7-angled, apex obtuse, obscurely mucronulate. Middle and upper cauline leaves bearing axillary flowers, simple or rarely 1 or 2 with a lateral, leaflet-like lobe, suborbicular to ovate, angled, not crenate, progressively smaller upward. Raceme bracteate throughout, very lax. Fruiting pedicels ascending, 1.5–3 cm long, slender, straight. Sepals ovate, 1.5–1.8 × 0.9–1 mm, apex membranous, base not saccate. Petals white, obovate, 3.5–4.5 × 1.5–2 mm, not clawed, apex rounded. Median filament pairs ca. 2.5 mm long, lateral pair ca. 2 mm long; anthers oblong, ca. 0.6 mm long. Ovules 20 to 24 per ovary. Fruit linear, 2–3.6 cm × ca. 1 mm, sessile; valves glabrous, smooth; style 1–2 mm long. Seeds brown, oblong, 1.2–1.4 × 0.7–0.9 mm, wingless.

*Phenology*. Flowering and fruiting in June.

*Cardamine lihengiana* is dramatically different from all Eurasian species of the genus in having very lax racemes that are bracteate throughout. There are several American species of *Cardamine* with bracteate inflorescences, but the new species is clearly unrelated to them because it has palmately instead of pinnately veined leaves. *Cardamine lihengiana* is most closely related to the species group including *C. circaeoides* J. D. Hooker & Thomson and its relatives. This group has simple,

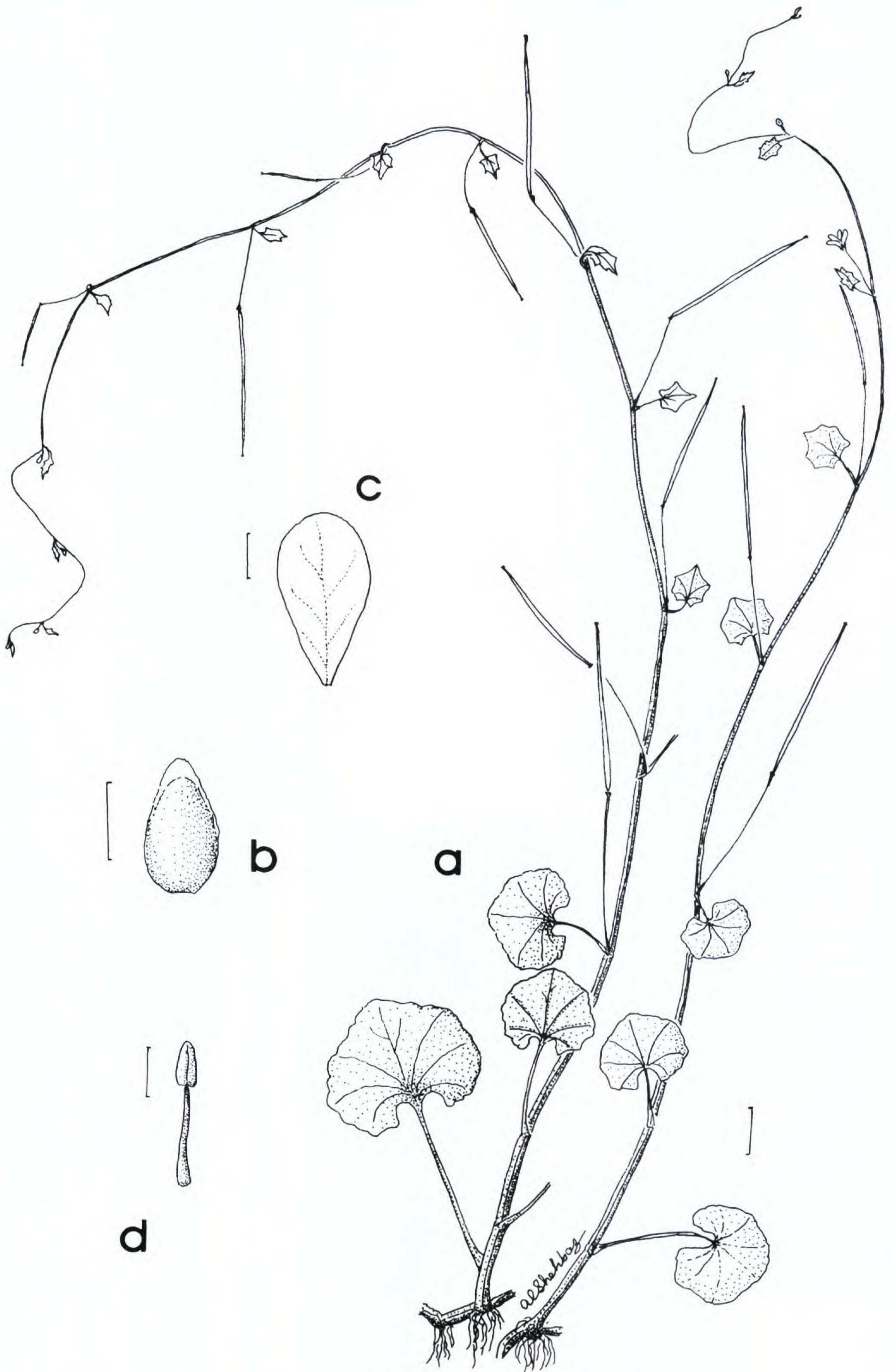


Figure 2. *Cardamine lihengiana* Al-Shehbaz. —A. Plant. —B. Sepal. —C. Petal. —D. Median stamen. Scale: A = 1 cm; B–D = 1 mm. Drawn by Al-Shehbaz from the holotype (Li Heng, Chen Yü & Yü Hongyuan 1267).

reniform, palmately veined leaves, short rhizomes, and small, white flowers. The new species is named after Professor Li Heng (KUN), one of the collectors of the type collection.

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